ISOM4540 Time Series Analysis and Forecasting (L1)
Spring Semester 2024

Course Outline

Instructor:	Professor Jason Man Wai HO Senior Lecturer Department of Information Systems, Business Statistics, and Operations Management (ISOM)
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Class Schedule and Location

Lecture:	
1500 – 1620 (Wednesday & Friday) 31 January – 10 May 2024 (except 29 March, 3 & 5 April, and 1 May)	LSK 1009

Tutorial:	
1330 – 1420 (Wednesday) 14 February – 8 May 2024 (except 3 April, and 1 May)	LSK G021

Course Objective

Statistics play an important role in every discipline that utilizes data. The diverse areas involving using statistics include Science, Medicine, Engineering, Business, among others. Rather than cross-sectional data, we often encounter time series data collected repeatedly across a certain period of time, for example, daily returns of a stock in the last 2 years and monthly sales of some commodities in a 10-year period. Studying such data helps us address questions like future prospect of an investment in a stock and prediction of production target that will meet the future demand in the business world. Various statistical methods and forecasting techniques tailor-made for handling time series data were necessarily developed in place of other standard statistical techniques built upon certain independence assumptions in the data structure.

Upon completion of the course, students should be able to

- Have a basic understanding of common statistical methods for analysing time series data;

- Decide what time series analyses are most appropriate to use in a given situation, and understand their advantages and limitations;
- Interpret and present statistical results of time series analyses that are either self-produced or provided by others;
- Analyse real data via implementing common methods in time series analyses and forecasting by R.

Course Materials

- Class PowerPoints, and other materials available on course Canvas in HKUST iLearn (https://ilearn.ust.hk/iLearn/home.html), or HKUST iLearn App on App Store or Google Play
- Reference Textbooks:
  - ***Forecasting: Principles and Practice*** (2nd ed), Rob J Hyndman and George Athanasopoulos, OTexts (2018). Access the online textbook: https://otexts.com/fpp2/
  - ***Introductory Time Series with R (Use R!)***, Paul S.P. Cowpertwait and Andrew V. Metcalfe, Springer (2009).
  - ***Time Series Analysis and Its Applications (With R Examples)***, Robert H. Shumway and David S. Stoffer, Springer (2017).
- Required software: R

Learning Approach

- Lectures are designed to give an overview of the methodology and related concepts, aided by directed discussion. Their introduction in a relevant context will be followed by discussion of their applications to some real data.
- During tutorials, necessary R commands for implementing time series analyses covered in lectures will be introduced and discussed in details.
- Actively and repeatedly engaging in problem solving and reading is as important as following lectures and tutorials in view of mastering the course content.
- To facilitate the learning process, you will be given regular homework assignments which require writing short computer programs in R language. The assignments will be done in groups. Assignments must be completed in a professional/presentable manner.

Assessment

Your final grade will be based on the following activities:

1	Midterm Examination*	20%	Closed-book, with help sheet (one piece of A4-size paper with any content on both sides) allowed. On 27 March, 3:00-4:20pm, during lecture
2	Final Examination	55%	Closed-book, with help sheet (2 pieces of A4-size paper with any content on both sides) allowed. **Date & venue to be announced**

3	Assignment*	20%	There will be 3 sets of homework assignments. All use of generative AI is restricted. Students should form groups of 2 or 3 students to finish the assignments jointly. Free-riding or irresponsible behavior may result in lower individual mark. Group formation should be completed in Canvas by end of 18 Feb.
4	Individual Class Participation and Professionalism	5%	Classroom participation is crucial to a lively and effective learning environment. A lower score may happen due to, for instance, disruptive behavior, excessive absences (>30%) or refusal to answer questions.

*Feedback on these assessments will be provided within 10 working days after submission.

Academic Integrity

Without academic integrity, there is no serious learning. All HKUST members (students & staff) should hold a high standard of academic integrity. Academic integrity is of the greatest importance, and thus there should be ZERO tolerance for academic dishonesty in this course. Any violation will lead to serious consequences. Please ensure a strict adherence to the HKUST Academic Honor Code at all times (see https://registry.hkust.edu.hk/resource-library/academic-honor-code-and-academic-integrity).

Course Plan

Module/Activity	Date
Module 1. Introduction	Jan 31
Module 2. Time Series Features	Feb 2, 7, 9
Module 3. The Forecaster's Toolbox	Feb 14, 16
Module 4. Time Series Decomposition	Feb 21
Module 5. Time Series Regression Models	Feb 23, 28; Mar 1, 6, 8
Module 6. Exponential Smoothing	Mar 13, 15, 20
Midterm Examination on Modules 1-5	**Mar 27**
Module 7. ARMA Models	Mar 22; Apr 10, 12, 17, 19
Module 8. ARIMA Models	Apr 24, 26; May 3, 8